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A COMPARISON OF TWO METHODS OF STUDYING WITH APPLICATION TO FOREIGN LANGUAGE

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The purpose of this study is to determine the relative value of two methods of studying paired associates. By paired associates is meant two lists of words, one opposite the other. An excellent example of this is a list of words with definitions or a foreign vocabulary with the English equivalents. Thus the foreign words might be regarded as the basic element, while the English equivalents would be called the associates. In the materials of the experiments described in this study proper names are the fundamentals, and each one has associated with it a descriptive adjective; the adjectives thus become the associates.

A first method is labeled recall, while a second method is named study. In using the first method the students divided their time into two parts: first, they studied the series for a certain length of time and, second, they spent the balance of the time in recalling as many of the associates as possible. While working with the second method the subjects spent the entire time in trying to fix the correct associates; that is, their whole time was spent in studying without trying to test their memory by the recall method. Thus it is noted that what has been mentioned as a distinction between the study and recall methods is largely a matter of the division in the use of the allotted time. When a student uses the study method, he spends the entire time endeavoring to fix each associate with its correct fundamental; he deliberately refrains from testing his grasp of the material by looking away from the paper and saying as many as possible from memory. On the other hand, when one is employing the recall method, he follows the procedure just described, but after a certain period of time only the associates are removed and the student endeavors to

recall from memory during the remainder of the specified time as many as possible of the associates in connection with the correct fundamentals.

The subjects in this experiment were students in the classes in psychology at Northwestern University. All were in the second, third, or fourth year of college work. Both men and women were in each of the groups.

The procedure of the experiment was as follows: The material employed consisted of fifteen proper names with a descriptive adjective after each name. For the sake of clearness one of the lists of names and adjectives is presented at this point:

Hammond—religious	Walker—neat
Rosenow—experienced	Ruml—resourceful
Hardy—fat	Byrne—spendthrift
Judd—tall	Bradam—skinny
Angell—interesting	Stokes—bluffer
Wooley—studious	Higgins—strong
Merrill—practical	Kirk—crude
Dalton—exceptional	

The object in the learning was to be able to fix the right associate with each name. The students were given full explanation as to what was expected of them. They were urged very strongly that during the time they were studying the names they were not to stop and try to recall them from memory. The recall or test group studied for three minutes; then the original papers were collected and a second sheet was passed to the subjects on which were typed the names without the associates; they were allowed two minutes in which to write as many of the adjectives as possible. Thus, with the recall group, the time was divided into three minutes' study, interval of two minutes, and recall of two minutes. After giving the same explanation and warning to the subjects in the study or control group, sheets with the same list of names were given them. These students were permitted to study the associates for three minutes; turn over the papers for a period of two minutes and then study for an additional two minutes. It is observed that each of the two groups endeavored to learn the material for a period of five minutes; the difference

was in the manner of employing the last two minutes. The aim in this experiment was to discover what effect this difference in the last two minutes had upon the retention of the material. To determine this result the retention of each group was tested after an interval of four days. The results of this part of the experiment will be found in Table I.

TABLE I
COMPARATIVE RESULTS OF THE TWO METHODS

Group	Subjects	Average	Percentage Score	Percentage Better
Recall (A).....	37	7.19	47.9	27.7
Study (B).....	29	5.62	37.5

The names to the left in the table indicate the respective groups. Included in the table for each group are the number of subjects, average number of correct associates retained, the percentage of the fifteen pairs remembered, and the percentage that either method is better.

It is to be noted that the recall group did better in whatever terms the results are stated. In other words, the recall group did nearly 28 per cent better; the study group did not do quite three-fourths as well as its competitor. For these results there are several possible causes. It may be that the one group is superior in ability. Recall may have been the deciding element. Two additional factors were in favor of the test group, that of writing and of position; during the two minutes of immediate recall the words were written and the position of the words was the same as that employed in the delayed recall. Before any conclusions can be drawn it is necessary to determine the main causal factors.

In order to determine the effect of group differences, a second list of fifteen names with associates was employed. After an interval of about a month a second experiment was performed. This time Group A studied while Group B employed recall. The previously described method of procedure was also followed in this instance. The results are given in Table II.

TABLE II
RESULTS OF THE SECOND EXPERIMENT

Group	Subjects	Average	Percentage Score	Percentage Better
Recall (B).....	30	7.17	47.8	19.5
Study (A).....	40	5.98	39.9

In this experiment retention was also tested after an interval of two weeks. These data are presented in Table III.

By studying the data of Tables II and III it is found that the recall group does much better in the three instances of measurement when retention is tested after an interval of four days or after two weeks. It is interesting to observe that the average and percentage scores, larger in Table III than in Table II, are evidence in favor of the recall method. Both groups spent the same amount of time in recall at the four-day period; ten days later the score of each group had improved. However, the per-

TABLE III
RESULTS OF SECOND EXPERIMENT AFTER TWO WEEKS

Group	Subjects	Average	Percentage Score	Percentage Better
Recall (B).....	30	7.50	50.0	15.4
Study (A).....	40	6.49	43.3

centage better decreased by two points. The cause of this is unknown.

At this point the conclusion can be made that the superiority of the recall method is not due to group differences. Moreover, it is not thought that the difference in difficulty of the material studied is significant. The closeness of the results in the two experiments is highly suggestive of a close similarity in difficulty of material. The validity of the foregoing conclusion is strengthened by comparing the results from the same group when using different methods of studying. To facilitate this comparison Table IV was prepared.

TABLE IV
COMPARISON OF RESULTS FROM SAME GROUP

	AVERAGE	PERCENTAGE SCORE	PERCENTAGE BETTER
Group A			
Recall.....	7.19	47.9	22.5
Study.....	5.98	39.9
Group B			
Recall.....	7.17	47.8	27.4
Study.....	5.62	37.5

It is readily seen when observing the data in this table that each group excels when employing the recall method; each group does practically one-fourth better under this condition.

Further, a much larger percentage of the individual students did better when using recall. The record of each subject in the two experiments was compared, noting whether he did better or worse, or whether there was no change when employing the recall method. The percentage of the total number of subjects in the gaining, the losing, and the stationary groups was then computed. Table V contains these data. Note that from 65 to 76 per cent of the individuals retain more under conditions of recall; from 16 to 24 per cent retain less; while from 8 to 10 per cent do equally well with either method. Thus it is seen that the large majority of the individual subjects do better with the aid of recall.

TABLE V
PERCENTAGE OF STUDENTS SHOWING GAIN, LOSS, AND NO CHANGE UNDER
CONDITIONS OF RECALL

	Gain	Loss	No Change
Group A.....	65.51	24.14	10.35
Group B.....	76.00	16.00	8.00

To determine the significance of the positional element in the recall method, two additional groups of subjects learned the two sets of material described above, employing the recall method under the same conditions as those of the previous groups with

one exception. When tested for retention at the end of four days, the stimulus words were presented in a different order from that used when testing immediate recall. To be more specific, the difference in the methods these two groups employed was this: In the first two experiments the original material was arranged as follows:

Name	Associate
1.....	A
2.....	B
3.....	C
4.....	D
Etc.....	Etc.

The group employing the recall method had the names presented to them during the time of recall in this changed order: 3, 5, 6, 2, 1, etc. This last-mentioned order was used in the tests for retention four days later. Thus it is seen that the recall groups at the time of testing retention had had previous experience with the order in which the names of the series were presented. This is what is referred to as the positional element, and it is the effect of this factor that is to be determined at this point. Table VI contains the data for this comparison.

TABLE VI
COMPARISON OF RESULTS TO DETERMINE EFFECT OF POSITIONAL ELEMENT
IN RECALL

GROUP	SUBJECTS	AVERAGE	PERCENTAGE SCORE	PERCENTAGE BETTER
Series X				
Test (B).....	30	7.17	47.80	16.1
Control (C).....	28	6.18	41.20
Series Y				
Test (A).....	37	7.19	47.90	18.5
Control (D).....	33	6.06	40.04

The test groups in this experiment had the positional element in their favor while the control groups followed the same method of procedure but lacked the use of the position of the series. The test groups have better scores when stated in both relative and absolute terms. In both instances the test groups did from 16 to

18 per cent better. It is very doubtful that chance caused these results; the similar results obtained in the two comparisons tend largely to eliminate this factor. The group difference factor proved to be of negative value. Hence, the conclusion is justified that positional element is the main causal factor in determining the results in Table VI. In other words, the positional element is a significant cause in fixing in memory paired associates; it is one of the factors in determining the superiority of the recall method of studying.

For the purpose of comparing the value of writing as one of the aids in fixing the associates, Group C after an interval of several weeks learned Series Y. In the foregoing test Group D had

TABLE VII
COMPARISON OF RESULTS TO DETERMINE EFFECT OF WRITING IN RECALL

Group	Subjects	Average	Percentage Score	Percentage Better
Test (D).....	33	6.06	40.4	6.5
Control (C).....	28	5.70	37.9

TABLE VIII
RESULTS FROM SAME GROUP (C)

With Writing.....	33	6.18	41.2	8.7
Without Writing...	28	5.70	37.9

studied Series Y by the recall method without the positional element, but with writing; Group C now learned the same series without the positional element but with writing. To accomplish this result, the stimulus words were given the subjects and they recalled for two minutes from memory but did not write down the associates recalled. In Tables VII and VIII will be found the results for this part of the experiment.

In addition to comparing the data of different groups on the same material, results from the same group (C) with different materials can now be compared. This group followed the same procedure in the two tests, except when studying Series X the recalled associate was written opposite the name, but on learning Series Y the adjectives were recalled but were not written.

In both instances of comparison the results are superior when writing was employed. The test group did 6.5 per cent better than the control group while the same group improved nearly 9 per cent with the aid of writing. It is thought that these results are not due to group or chance differences, nor to difficulty of material, but rather to the factor of writing. From these data the conclusion may be drawn that writing is one of the causal factors in determining the superiority of the recall method. This conclusion is supported with the data obtained by computing the percentage of individuals affected by the writing. It was found that 57.15 per cent of the subjects in Group C did better when writing, 38.09 per cent showed a loss, while 4.76 per cent were not affected by the change of method.

The outstanding conclusion based upon the data of this experiment is that the recall method is superior as an aid in the mastery of paired associates, determined by tests for retention. This is true whether considering group or individual results. Both groups obtained results superior by from 20 to 27 per cent when employing the method of recall. Sixty-five per cent of the individual subjects in one group and 76 per cent of the members of the second group attained a better score under the conditions of recall. This conclusion is further supported when the correlation between immediate and delayed recall for the two groups is computed. The correlation for Group A is .79 while that for Group B is .92. This means that those students who were able to recall the more correct associates in the first instance also obtained the higher scores when testing retention four days later. In other words, the first recall had so aided in fixing the series in memory that the correct associates were the better retained over the longer period.

This result cannot be due to mere chance differences; the consistency with which the results proved the superiority of the method of recall eliminates the possibility of chance being a significant factor. Recall remained the superior method when different groups learned the same series and also when the same group learned different associates. This fact proves that differences in the ability of the groups could not cause the results. The two series employed in the experiment are highly similar in difficulty;

the close agreement of the scores in Tables I and II support this statement. Hence, the probability of difference in material being a significant factor is removed. The factors producing the foregoing results have been proved to be three, namely, recall, writing, and the position of the associates in the series. The writing and positional factors were isolated and proved to be significant; recall was present in each test and apparently was a causal factor; note the slightly superior results obtained in the first two experiments. It was proved beyond doubt that when the three elements were combined superior results were obtained.

The materials of this experiment are similar to a foreign-language vocabulary of equal length with English equivalents. The applications of the experimental results to the mastery of a foreign vocabulary are readily made. A more positive test of this application is the next part of this experiment.

For the material in this experiment fifteen Hebrew words were selected and transliterated into the English alphabet. This gave words of a foreign vocabulary that were totally unfamiliar to the students, with English equivalents. The list is as follows:

Gagelakah—kingdom	Amar—wool
Midekkar—wilderness	Peah—mouth
Ishon—strength	Rohab—pride
Mahalak—journey	Ummah—association
Tashubah—return	Sheleg—snow
Yekum—substance	Quadash—clean
Avvehreth—blindness	Tsiyba—station
Irak—fugitive	

The subjects were men and women in two additional classes in psychology, called Group E and Group F, respectively. Group E studied the series five minutes, then employed recall under the same conditions as above for three minutes. Group F studied the associates continuously for eight minutes. Retention was tested at the end of seven days. The data are presented in Table IX.

TABLE IX
COMPARISON OF RESULTS WHEN LEARNING HEBREW VOCABULARY

Group	Subjects	Average	Percentage Score	Percentage Better
Recall (E).....	22	6.27	41.8	101.9
Study (F).....	20	3.10	20.7

Group E secured a better score when stated in absolute or in relative terms. When comparative terms are used the test group (E) did twice as well as the control group (F); in other words, E did over 100 per cent better. In point here are all proofs and arguments presented above, as to the cause of this result. Hence, it can be concluded that of the two methods, recall is superior for memorizing a foreign vocabulary. Naturally the question arises as to what use the teacher may make of the experimental results presented in this paper. Several items may be noted. In any instance where the student has to memorize paired associates, e.g., learning a foreign vocabulary, the teacher should explain how to use the recall method. In the procedure, members of the series should be kept in their original order, making use of the positional element. After the material is well learned, this element will probably not be needed. Students should be urged also to use writing as an aid in learning. Thus the teacher would be making use of the recall method for the entire group of students.

Due allowance should be made for individual differences. No method is apt to be best for all the students. It will be remembered that from 65 to 76 per cent of the subjects did better under the conditions of recall. With from 8 to 10 per cent it made no difference which method was used, while from 16 to 24 per cent made a poorer record when using the recall method. A short experiment on the order of the one here presented could be made to discover such individual differences. In the matter of writing, individual variations again manifest themselves. Fifty-seven per cent of the students did better by writing, while 38 per cent made a lower score. Evidently, not all students should be made to write in the memorization of materials. This could easily be tested out in a short time in any class. Two short vocabularies of the same relative difficulty could be selected. One day the students might learn one series with writing; the next day they might learn the other series without writing. A comparison of the records of each student for the two days and after an interval of several days a test for retention will disclose which students need writing as an aid in learning. Having this information, the teacher certainly should suit the instruction to the individual needs of her pupils.